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BUREAU OF ANIMAL INDUSTRY
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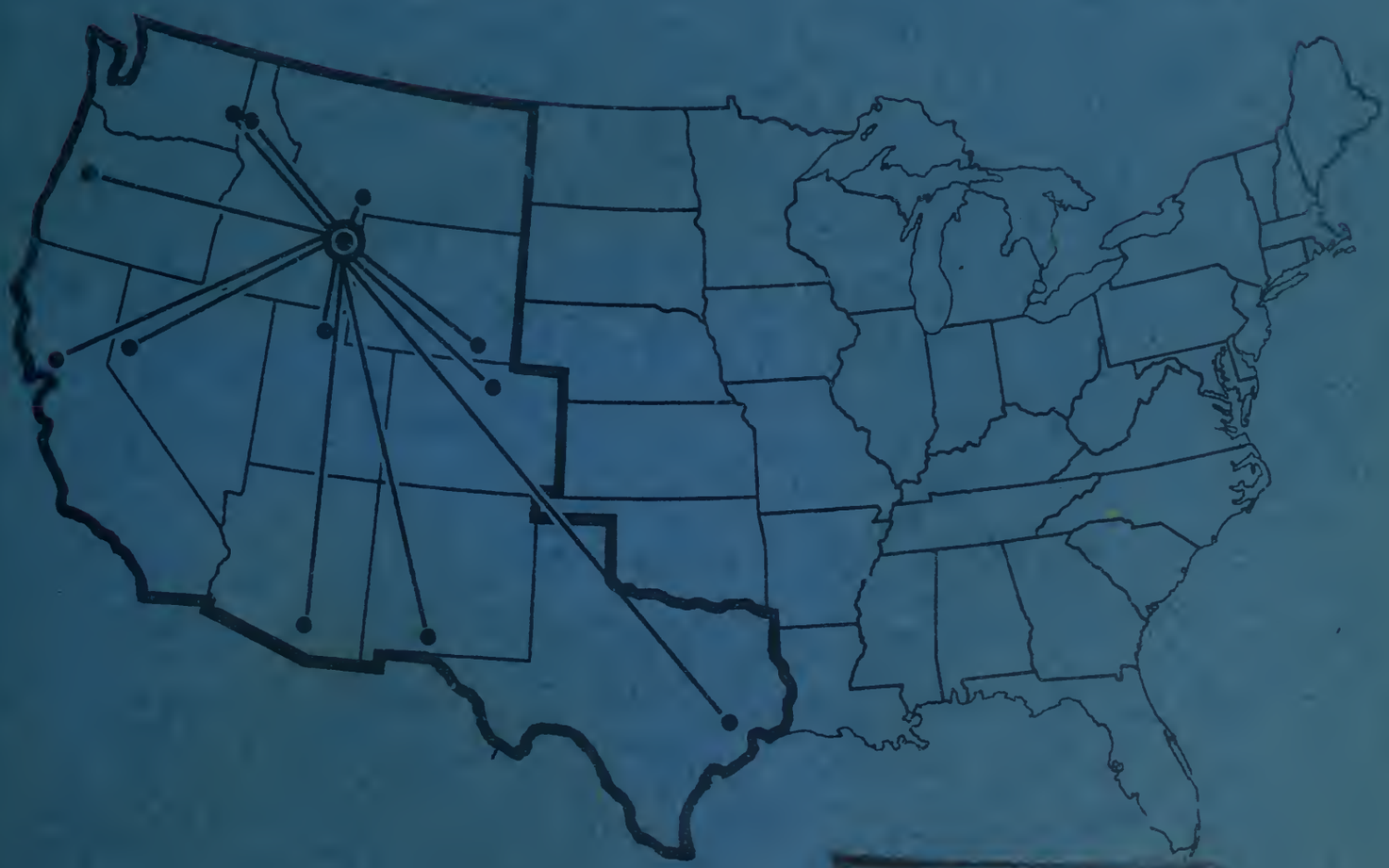
TWELFTH ANNUAL REPORT OF THE

WESTERN SHEEP BREEDING LABORATORY

DUBOIS, IDAHO

JUNE 30, 1949



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ANNUAL REPORT
Western Sheep Breeding Laboratory
June 30, 1949

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DIRECTORS OF STATE AGRICULTURAL EXPERIMENT STATIONS
OF THE TWELVE WESTERN STATES THAT ARE COLLABORATING
WITH THE WESTERN SHEEP BREEDING LABORATORY

ARIZONA:	P. S. Burgess, University of Arizona, Tucson.
CALIFORNIA:	C. B. Hutchison, University of California, Berkeley.
COLORADO:	H. J. Henney, Colorado State Agricultural College, Fort Collins.
IDAHO:	Donald R. Theophilus, University of Idaho, Moscow.
MONTANA:	Clyde McKee, Montana State College, Bozeman.
NEVADA:	C. E. Fleming, Nevada Agricultural Experiment Station, University of Nevada, Reno.
NEW MEXICO:	H. R. Varney, Director, New Mexico State College of Agriculture, State College.
OREGON:	W. A. Schoenfeld, Oregon State College, Corvallis.
TEXAS:	R. D. Lewis, Agricultural and Mechanical College of Texas, College Station.
UTAH:	R. H. Walker, Utah State Agricultural College, Logan.
WASHINGTON:	Mark T. Buchanan, Washington State College, Pullman.
WYOMING:	J. A. Hill, University of Wyoming, Laramie.

COLLABORATORS OF THE WESTERN SHEEP BREEDING LABORATORY

ARIZONA:	Ernest B. Stanley, Head, Department of Animal Husbandry, College of Agriculture, University of Arizona, Tucson.
CALIFORNIA:	James F. Wilson, Division of Animal Industry, College of Agriculture, University of California, Davis.
COLORADO:	H. H. Stonaker, Department of Animal Husbandry, Colorado State College of Agriculture and Mechanic Arts, Fort Collins.
IDAHO:	C. W. Hickman, Head, Department of Animal Husbandry, College of Agriculture, University of Idaho, Moscow.
MONTANA:	J. L. Van Horn, Department of Animal Husbandry, Montana State College, Bozeman.
NEVADA:	Charles E. Fleming, Director, Nevada Agricultural Experiment Station, University of Nevada, Reno.
NEW MEXICO:	Philip E. Neale, Department of Animal Husbandry, New Mexico College of Agriculture and Mechanic Arts, State College.
OREGON:	F. F. McKenzie, Chairman, Department of Animal Husbandry, Oregon State Agricultural College, Corvallis.
TEXAS:	Bruce L. Warwick, Department of Animal Industry, Texas Agricultural Experiment Station, Bluebonnet Farm, McGregor, Texas.
UTAH:	Louis L. Madsen, Head, Department of Animal Husbandry, Utah State College, Logan.
WASHINGTON:	M. E. Ensminger, Head, Department of Animal Husbandry, State College of Washington, Pullman.
WYOMING:	Elden K. Faulkner, Department of Animal Production, College of Agriculture, University of Wyoming, Laramie.

ROSTER OF PERSONNEL

WESTERN SHEEP BREEDING LABORATORY AND U. S. SHEEP EXPERIMENT STATION
Dubois, Idaho
June 30, 1949

Name	Rating	Date Entered on Duty	General Duties
Nordby, Julius E.	Animal Husbandman	Mar. 1, 1938	Director
Terrill, Dr. Clair E.	Animal Husbandman	July 3, 1936	Genetics and Physiology
Stoehr, John A.	Animal Husbandman	Aug. 28, 1928	Operations
Emik, Dr. L. Otis	Animal Husbandman	July 7, 1941	Statistics and Genetics
Wilson, Lowell O.	Foreman of Farm Laborers	July 1, 1943	Assistant, Operations
Schaefer, Chester F.	Clerk	June 22, 1936	Chief Clerk
Hensley, Gladys L.	Clerk	Aug. 4, 1947	Clerk
Taylor, Jessie S.	Clerk	Aug. 25, 1947	Clerk
Twardak, Dorothy M.	Clerk	Sept. 7, 1948	Clerk
Jeffery, Lee C.	Foreman of Farm Laborers	June 7, 1924	General Maintenance, Pumps, Equipment
Rasmussen, Jr., Henry	Farm Laborer	July 1, 1926	Sub-Foreman
Anderson, Daniel	Farm Laborer	Aug. 4, 1947	Shepherd
Bybee, Bert L.	Farm Laborer	April 4, 1949	Farm Laborer
Gates, Kendrick J.	Farm Laborer	Nov. 29, 1948	Shepherd
Goldman, James R.	Farm Laborer	May 1, 1939	Shepherd
Hohman, Max E.	Farm Laborer	April 1, 1935	Shepherd
Howard, John H.	Farm Laborer	Oct. 2, 1944	Camp Tender
Ingram, Parley F.	Farm Laborer	Apr. 20, 1947	Shepherd
Phillips, Walter H.	Farm Laborer	Mar. 16, 1935	Truck Driver
Powell, Fred A.	Farm Laborer	May 11, 1935	Teamster
Swink, Albert B.	Farm Laborer	May 31 1946	Farm Laborer
Nantz, Mrs. Dorinda R.	Laborer	June 16, 1941	Janitress and Cook

OBJECTIVE

The main objective of this Laboratory is to improve sheep for lamb and wool production under range conditions. In the pursuit of this objective basic breeding methods are employed; heritability analyses are made of the various utility factors, and the selection of breeding animals is based upon production as that is measured under range environment. Emphasis is placed primarily on the quantity and quality of lambs produced; the length, quality and quantity of clean scoured wool, and upon the adaptability and longevity of the sheep.

RESEARCH LINE PROJECTS

1. Development of systems of breeding for locating strains of Rambouillet sheep which may possess combinations of genes that will improve strains with which they may be crossed. This research line project includes;

    (a) The development of inbred strains or lines by the mating of animals as closely related as possible or desirable, and with emphasis on selection for all characters of economic importance.
    (b) The development of inbred lines with special reference to very important characters that are of economic importance to range sheep, such as mutton form, length of staple, and faces that are free from excess wool covering causing wool blindness.
    (c) The development of a non-inbred control group.

2. Determination of the inheritance of various undesirable characteristics of Rambouillet sheep, such as abnormalities in the growth of wool, hairiness in fleeces of wool and excessive skin folds or wrinkles, for the purpose of developing methods of breeding by which these undesirable characteristics may be eliminated from the stock.

3. Studies in the physiology of reproduction of Rambouillet sheep as they may contribute to the program of the Western Sheep Breeding Laboratory, including:

    (a) Sexual maturity of Rambouillet ram lambs;
    (b) Quality of semen in relation to fertility; and
    (c) Factors affecting fertility of ewes.

4. Studies in the physiology of wool production of Rambouillet sheep, including reference to fiber uniformity within and between various regions of the fleece in relation to the total uniformity of the fleece.

5. Analysis of records of the characteristics of sheep and wool to determine the usefulness of such records in the program of the Western Sheep Breeding Laboratory.

PUBLICATIONS

The following papers have been published or mimeographed since the beginning of the Western Sheep Breeding Laboratory in 1937. The complete list is included again this year for your convenience. Only the publications contributed to by the Western Sheep Breeding Laboratory are included in this list. Those publications which were also contributed to by the U. S. Sheep Experiment Station are starred. A number of contributions have been made to livestock journals and the general press that are not included in this series. They are for the most part adaptations of the regular series but rewritten for the lay reader.

5. Reproductive Capacity of Rambouillet Ram Lambs as Indicated by Semen Tests. C. E. Terrill, Proc. of the Amer. Soc. of An. Prod., 1938, pp. 308-310.

* 6. A Preliminary Study of the Relation Between Fleece Characteristics of Weanling and Yearling Range Sheep. W. V. Lambert, J. I. Hardy and R. G. Schott, Proc. of the Amer. Soc. of An. Prod., 1938, pp. 298-303.

* 7. Reproduction in Range Sheep. C. E. Terrill and John A. Stoehr, Proc. of the Amer. Soc. of An. Prod., 1939, pp. 369-375.

* 8. Selection of Range Rambouillet Ewes, C. E. Terrill, Proc. of the Amer. Soc. of An. Prod., 1939, pp. 333-340.

* 9. Comparison of the Accuracy of Two Methods of Estimating Fineness of Wool Fibers. Ralph W. Phillips, R. G. Schott, J. I. Hardy and H. W. Wolf, Jour. of Agr. Res. 60(5):343-350, Mar. 1, 1940.

*11. The Western Sheep Breeding Laboratory and U. S. Sheep Experiment Station. Julius E. Nordby. Extension Animal Husbandman, Sept., 1940.

12. Genetics and Range Sheep Improvement. Julius E. Nordby. Scientific Monthly 51:310-320, Oct., 1940.

*14. The Application of a Rapid Comparator Method for determining Fineness and Variability in Wool. Elroy M. Pohle, Proc. of the Amer. Soc. of An. Prod., 1940, pp. 161-168.

*16. Growth in Corriedale and Rambouillet Sheep under Range Conditions. Ralph W. Phillips, John A. Stoehr and G. W. Brier, Proc. of the Amer. Soc. of An. Prod., 1940, pp. 173-181.

*17. Sheep Improvement for Range Production. Julius E. Nordby, Idaho Forester 23, 1941, Forestry School, University of Idaho.

18. A Rapid Method for expressing Medullation in Wool. Elroy M. Pohle, A.H.D. No. 41, May 1941, 6 pp. (Processed).

21. Face Covering in Range Sheep. Clair E. Terrill. A.H.D. No. 49, Nov., 1941, 9 pp. (Processed).

*22. Wool Yield Determination in which Small Samples are Compared with Whole Fleeces. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer, and Glenn W. Brier, A.H.D. No. 50, Jan., 1942, 6 pp. (Processed).

*23. Wool Yields in the Small Side-Sample as Related to Individual Whole Fleece Yields in Four Breed-Groups of Sheep. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer and Glenn W. Brier, Jour. of An. Sci. 1(2):137-144, May,1942.

*24. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1(3):221-228, Aug., 1942.

*25. Relationship Between Weanling and Yearling Fleece Characters in Range Sheep. Elroy M. Pohle, Jour. of An. Sci. 1(3):229-235, Aug., 1942.

*26. Staple Length in Relation to Wool Production. Elroy M. Pohle And Henry R. Keller, Jour. of An. Sci. 2(1):33-41, Feb., 1943.

27. Improving Rambouillet Sheep for Western Ranges. Julius E. Nordby, National Wool Grower 33(3):12-7, Mar., 1943.

*28. Staple Length and Its Influence on Shrinkage and Fleece Values. Elroy M. Pohle and Henry R. Keller, National Wool Grower 33(6): 22-24, June, 1943.

30. Sampling and Measuring Methods for Determining Fineness and Uniformity in Wool. Elroy M. Pohle, L. N. Hazel and H. R. Keller, U.S.D.A. Circular 704, August 1944. Revised March 1947.

31. Wool Fineness in Eight Sampling Regions on Yearling Rambouillet Ewes. Elroy M. Pohle and R. G. Schott, Jour. of An. Sci. 2(3):197-208, Aug., 1943.

32. Clean Wool Yield Variation Among Regions of Rambouillet Fleeces, Elroy M. Pohle, H. W. Wolf and Clair E. Terrill, Jour. of An. Sci. 2(3):181-187, Aug., 1943.

33. Fiber Density and Some Methods of its Measurement in the Fleeces of Rambouillet Sheep. H. W. Wolf, W. M. Dawson and E. M. Pohle, Jour. of An. Sci. 2(3):188-196, Aug., 1943.

*34. Estimation of Clean-Fleece Weight from Grease Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle, L. Otis Emik, and Lanoy N. Hazel, Jour. of Agr. Res. 70(1):1-10, Jan. 1, 1945.

*35. Clean-Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(2):159-165, May, 1944.

*36. Shrinkage and Value by Grades for 1943 Range Wool. Elroy M. Pohle and Henry R. Keller. National Wool Grower 34(6):22-23, June, 1944. (Published in other Wool Growers Magazines).

*37. Some Factors Affecting the Blood Phosphorus Level of Range Ewes. W. M. Beeson, Clair E. Terrill and D. W. Bolin, Jour. of An. Sci. 3(2):175-182, May, 1944.

*38. The Accuracy of Measurements and Weights of Sheep. Ralph W. Phillips and John A. Stoehr, Jour. of An. Sci. 4(3):311-316, Aug., 1945.

*39. Monthly Changes in Fineness, Variability and Medullation in Hairy Lambs. Elroy M. Pohle, H. R. Keller and L. N. Hazel, Jour. of An. Sci. 4(1):37-46, Feb., 1945.

40. More Profit in Open Face Ewes. Clair E. Terrill, Mont. Wool Grower 18(1):13,47. Jan., 1944. (Published in other Wool Growers Magazines).

*41. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yields. E. M. Pohle, L. N. Hazel and H. R. Keller, Jour. of An. Sci. 4(2):104-112, May, 1945.

*42. Wool Off-Sorts, Percentage, Shrink, Value. Elroy M. Pohle and Henry R. Keller, Montana Wool Grower 18(6):7, June, 1944. (Published in other Wool Growers Magazines)

43. Effectiveness of Selection on Progeny Performance as a Supplement to Earlier Culling in Livestock. G. E. Dickerson and L. N. Hazel, Jour. of Agr. Res. 69(12):459-476, Dec. 15, 1944.

*44. Looking Forward, The Stabilizing Influence of Research in a Changing Sheep Production Economy. Julius E. Nordby, National Wool Grower 35(6):18-19, 35-36, June, 1945.

45. The Etiology and Inheritance of Inequalities in the Jaws of Sheep. J. E. Nordby, C. E. Terrill, L. N. Hazel and J. A. Stoehr, Anat. Rec. 92(3):235-254, July, 1945.

46. Effects of Some Environmental Factors on Weanling Traits of Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill, Jour. of An. Sci. 4:331-341, Nov., 1945.

47. Heritability of Weaning Weight and Staple Length in Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill, Jour. of An. Sci. 4:347-353, November, 1945.

48. Heritability of Type and Condition in Range Rambouillet Lambs as Evaluated by Scoring, L. N. Hazel and Clair E. Terrill, Jour. of An. Sci. 5:55-61, February, 1946.

49. The Covariance Analysis of Multiple Classification Tables with Unequal Subclass Numbers. L. N. Hazel. Biometrics Bulletin 2(2):21-25, April, 1946.

50. Heritability of Face Covering and Neck Folds in Range Rambouillet Lambs as Evaluated by Scoring. Clair E. Terrill and L. N. Hazel. Jour. An. Sci. 5(2):170-179, May, 1946.

53. Effects of Some Environmental Factors on Fleece and Body Characteristics of Range Rambouillet Yearling Ewes. L. N. Hazel and Clair E. Terrill. Jour. An. Sci. 5(4):382-388, Nov., 1946.

*54. Length of Gestation in Range Sheep. Clair E. Terrill and L. N. Hazel. Amer. Jour. Vet. Res. 8(26):66-72, January, 1947.

55. Refining Methods of Using Opal Blue Stain in Evaluating Ram Semen. L. O. Emik and G. M. Sidwell. Jour. An. Sci. 6(1): 67-71, February, 1947.

*57. Range Sheep Improvement Through Selection. Clair E. Terrill, Nat'l Wool Grower 36(12):17-19, December, 1946.

*60. Its the Clean Wool in the Fleece That Pays Off. Elroy M. Pohle, Nat'l Wool Grower 37(5):19-20, May, 1947.

*61. Statistical Treatment of Trichostrongylid Eggs. L. Otis Emik, Biometrics 3(2):89-93, June, 1947.

*62. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Jour. of An. Sci. 6(4):467-475, Nov., 1947.

64. Tailless Sperm from Rams. L. Otis Emik and George M. Sidwell. Jour. of An. Sci. 8(1):67-72, Feb., 1949.

*65. Gestation Period in Sheep. Clair E. Terrill and John A. Stoehr. Sheep and Goat Raiser 28(6):23, March, 1948. (Published in other Wool Growers Magazines).

67. Effects of Some Environmental Factors on Traits of Yearling and Mature Rambouillet Rams. Clair E. Terrill, G. M. Sidwell and L. N. Hazel. Jour. of An. Sci. 7(3):311-319, Aug., 1948.

68. Improvement of Sheep for Western Ranges. Julius E. Nordby. To appear as a U.S.D.A. Misc. Publication.

*69. Effect of Feed and Sickness on Wool Growth. Elroy M. Pohle. National Wool Grower. 37(6):9, June, 1947.

*70. High Producing Rams Important. Elroy M. Pohle. National Wool Grower 38(1):21-22, January, 1948.

*71. Fleece Value Increases with Staple Length. Thos. D. Watkins, Jr. National Wool Grower 38(10):17-18, October, 1948. (Published in other Wool Growers Magazines).

*72. Systematic Procedures for Calculating Inbreeding Coefficients. L. Otis Emik and Clair E. Terrill. Journal of Heredity 40(2): 51-55, Feb., 1949.

*73. Increasing Efficiency in Selecting Rams. Clair E. Terrill. To be processed by A. H. Div., Bur. of An. Ind. U.S.D.A.

74. The Relation of Face Covering to Lamb and Wool Production in Range Rambouillet Ewes. Clair E. Terrill. In Press, Journal of Animal Science.

*75 Activating Genetic Concept into Range Sheep Improvement. Julius E. Nordby, Northwest Science. 22(2):60-68, May, 1948.

76. The Effects of Environmental and Hereditary Factors on Trichostrongylid Worm Infestation in Sheep. L. Otis Emik. Jour. of An. Sci. 8(1):73-80, Feb., 1949.

*77. Science as a Means of Sheep Improvement. Julius E. Nordby. Montana Wool Grower 23(1):17, 64, January, 1949.

*78. Dangers and Benefits of Inbreeding. Julius E. Nordby, National Wool Grower 39(1):12-13,40,42, January, 1949.

79. Some Profitable Improvements in Rambouillet Sheep. Julius E. Nordby. San Angelo Standard Times, May 1, 1949.

80. More Lambs from Open-Faced Ewes. Clair E. Terrill. For National Wool Grower.

*81. Supplemental Grain for Wintering Ewe Lambs. John A. Stoehr and Clair E. Terrill. For National Wool Grower.

*82. Comparison of Elastrator with Cutting for Docking and Castrating. Clair E. Terrill and John A. Stoehr. For National Wool Grower.

83. Selecting Rambouillet Ewes for High Lamb Production. Clair E. Terrill. For Journal of Animal Science.

ABSTRACTS

The following abstracts have been published since the beginning of the Western Sheep Breeding Laboratory in 1937. Those which have also been contributed to by the U. S. Sheep Experiment Station are starred. These abstracts are in general of work that has been or will be published and listed in the regular series of publications.

* 1. Relationship Between Weanling and Yearling Fleece Characters in Range Sheep. Elroy M. Pohle, Jour. of An. Sci. 1(1):60, Feb., 1942.

* 2. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1 (1): 60-61, Feb., 1942.

3. Fineness of Fiber in Eight Sampling Areas on Yearling Rambouillet Ewes. Elroy M. Pohle and R. G. Schott, Jour. of An. Sci. 1(4):356, Nov., 1942.

4. Clean Wool Yield Variation Among Regions of Rambouillet Fleeces. Elroy M . Pohle, H. W. Wolf and Clair E. Terrill, Jour. of An. Sci. 1(4):356,357, Nov., 1942.

* 5. Estimation of Clean Fleece Weight from Unscoured Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle and L. Otis Emik, Jour. of An. Sci. 1(4):357, Nov., 1942.

6. A study of the Fiber Density of the Fleeces of Rambouillet Sheep. H. W. Wolf, W. M. Dawson and E. M. Pohle, Jour. of An. Sci. 1(4):357-358, Nov., 1942.

7. Heritability of Yearling Fleece and Body Traits of Range Rambouillet Ewes. Clair E. Terrill and Lanoy N. Hazel, Jour. of An. Sci. 2(4):358-359, Nov., 1943.

* 9. Clean Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 2(4):370, Nov., 1943.

10. Sampling and Measuring Methods for Determining Fineness and Uniformity in Wool. Elroy M. Pohle, L. N. Hazel and H. R. Keller, Jour. of An. Sci. 2(4):371, Nov., 1943.

11. Effects of Some Environmental Factors on the Weanling Traits of Range Sheep. L. N. Hazel and Clair E. Terrill, Jour. of An. Sci. 3(4):432, Nov., 1944.

*12. The Gestation Period of Range Sheep. Clair E. Terrill, Jour. of An. Sci. 3(4):434-435, Nov., 1944.

*13. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yield. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(4):452, Nov., 1944.

14. The Etiology and Inheritance of Inequalities in the Jaws of Sheep. Julius E. Nordby, Clair E. Terrill, Lanoy N. Hazel and John A. Stoehr, Anat. Rec. 91(4):30, April, 1945.

15. The Construction and Use of a Selection Index for Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill. Jour. of An. Sci. 5(4):412, Nov., 1946.

*16. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Anat. Rec. 97(3):69-70, March, 1947.

*19. The Effects of Environmental and Hereditary Factors on Trichostrongylid Worm Infestation on Sheep. L. Otis Emik and Paul W. Gregory. Journal of Animal Science 6(4):477-478, Nov., 1947.

20. The Relation of Face Covering to Lamb Production in Range Rambouillet Ewes. Journal of Animal Science 6(4):479, November, 1947.

*21. Predicting Live Normal Sperm in Rams from Motility Scores. L. Otis Emik, Clair E. Terrill and Geo. M. Sidwell. Jour. An. Sci. 7(4):511, November, 1948.

SOME PROFITABLE IMPROVEMENTS IN RAMBOUILLET SHEEP*

The Rambouillet breed and its progenitor, the Merinos, have served the sheep husbandmen for many centuries. Pastoral economy in many lands has involved essentially fine-wool production. In other lands, such as our own, the fine-wools have been the foundation for sheep husbandry and the basis for new breed types. They are the oldest of the significant world-wide important types, and despite the hardships of adverse environments such as severe heat, drouth, and cold, and also the idiosyncrasies of man in his selection for various external type patterns from time to time, the fine-wool has survived as the most generally adapted in the big family of sheep types. Inasmuch as the fine-wool has been subjected to rugged environments for centuries nature has had no small part in perpetuating vigor in them.

It is significant that the potential inheritance of a relatively long life, a broad environmental adaptability, and strong production have apparently not suffered a great deal even though, during some periods, selection has laid more emphasis on external patterns such as body wrinkles, wool covering over the face, heavy yolk production and other superficial characteristics that have very little if any positive economic value. A type of sheep that has been able to survive despite these encumbrances, and the producers that have been able to endure a rugged economy despite the disadvantages of wool blindness, heavy skin wrinkles and excessive wool-grease production in their sheep should form a hopeful sheep husbandry when the new natural open face, smooth body, long staple, light shrink type comes into general use.

At this station the only thing that is emphasized is production, as that is carefully measured in sheep that are maintained under range conditions. If and when improvement is made under these conditions it is reasonable to assume that it will have a good chance to carry over into the commercial flocks on the western ranges.

WOOL BLINDNESS

Approximately 25 percent of the job of opening up the faces in the Rambouillet flock at this laboratory has been completed. But there are not enough of the good ones yet. However, it is felt that from here on the work should progress more rapidly because the opportunity for more effective selection should be increasing each year. Enough comparison, however, has now been made here between the production by open-faced and wool-blind Rambouillet ewes under our range conditions to have determined that the open-faced ewes produce on the average eleven pounds more lamb per year than the wool-blind ewes.

A simple problem will reveal the significance of the 11 pounds. If, in the Intermountain area, the first 50 pounds of lamb produced per ewe are required to pay cost of production, then an average 70 pound lamb from the wool blind ewe would leave 20 pounds of lamb to

* Published in San Angelo Standard Times, San Angelo Texas, May 1, 1949.

market that would represent net income. Now since the average production of the open-faced ewe is 11 pounds more, or for convenience in figuring we will say 10 pounds, then we would have 30 pounds of lamb net income from the open-faced ewe against 20 pounds net income from the wool blind ewe. Thirty pounds is 50 per cent more net than 20 pounds. Since fine-wool lambs are produced essentially on the range, the increased lamb weight produced by the open-faced ewe is, generally speaking, a net difference.

It is highly significant in our flock operation. It will take some time to free the face of wool on all Rambouillet sheep on our ranges through selective breeding. The matter is, however, so important that every effort should be made for its accomplishment.

The face of the Rambouillet was covered up with wool because it was thought that the all-over wool pattern would yield more wool, and the body production would yield in proportion as the face was covered. It has been found at this laboratory that wool over the face does not insure a significant increase in wool production. By comparison, the wool blind ewes average only approximately one-tenth pound more grease wool than the open-faced ewes. This is now equivalent to about 6 cents. Note this is roughly the difference made up by the wool on the face of badly wool blind ewes which has very little value. The eleven pounds of lamb in favor of the open-faced ewe, at 20 cents a pound, equals $2.20. The covered face ewe would have to produce nearly four pounds of grease wool (at 60 cents per pound) more than the open-faced ewe to equal the advantage of 11 pounds of lamb that the open-faced ewe has in her favor.

NOT AN ADVANTAGE

The assumption that Rambouillet sheep with skin wrinkles produce significantly more wool than smooth ones is not in agreement with production records. Smooth ewes in the flocks at this laboratory produce as much clean wool as wrinkled ewes. Moreover, they produce a lighter shrink wool, are easier to shear, and when bred to smooth rams produce smooth lambs that escape a selling penalty for "heavy pelt." Skin and neck folds give rise to skin damage in shearing and often fly trouble.

Skin wrinkles are relatively easy to breed out of the Rambouillet. In the fall of 1948 at this laboratory 80 per cent of the weanling lambs were free from skin wrinkles and neck folds.

Ewes with heavy wrinkles usually produce significantly more yolk (wool grease) than smooth ewes. It has no value to the ranchman beyond the small amount that is necessary for keeping the wool fibers in good condition. More than that is excess baggage which adds to handling and selling costs.

LIGHT SHRINK IMPORTANT

The matter of shrink in wool is highly important. Let us assume two ten-pound fleeces. One has an actual shrink of 60 per cent and the other an actual shrink of 50 per cent. The former would yield 4 pounds of clean wool, the latter 5 pounds. It would cost the same to shear, transport, and market each of the two ten pound fleeces, roughly about $1 per fleece. On this basis there will be a charge of 25 cents against each pound of wool in the 4 pound clean weight wool fleece, and only 20 cents against each pound of the fleece yielding five pounds of clean wool. When this difference in shearing, transportation and selling costs of 5 cents per pound on the clean basis is changed to a percentage difference, it will be noted that since 25 cents is 25 per cent more than 20 cents there is a saving of 25 per cent in the above marketing costs between a 50 as against a 60 per cent shrinkage fleece. Increased density and length of staple are both favorable to light shrink. Both of these can be improved through selective breeding.

IMPORTANT TO KNOW

If in a 10 pound fleece the shrink is estimated at 60 per cent when it is actually by test only 55 per cent the following situation exists: On the estimated basis there would be 4 pounds of clean wool while on the test basis there would be 4½ pounds of clean wool. At $1 per pound it would bring on the estimated basis $4.00 and on the actual test basis $4.50. The difference in these two totals is a net difference. It is reasonable to assume that the ranchman would likely be willing to settle for $1 net from the $4 sale, all costs deducted. By the same token he would get $1.50 net from the $4.50 sale, a difference in net receipt of 50 per cent.

It is important to get paid for all of the wool in a clip for another very significant reason. It will require from 10 to 15 years of serious effort to change the heritage of a flock which averages ten pounds of wool in the grease to an average production of 11 pounds. A one pound increase in grease wool production is roughly equivalent to 1/2 pound of scoured wool. If now the clip is sold at an estimated shrinkage of 5 per cent too high, as in the above example, the ranchman forfeits 1/2 pound of scoured wool and the production gain it has required from 10 to 15 years to realize. The core test for testing shrinkage values has been found vastly superior to visual estimates for the ranchman's interest. When a load of wheat, which is roughly selling at 3 cents per pound is tested before it is sold, then it is all the more important to determine the amount of clean wool in a clip before it is sold because at this writing fine-wool is selling for approximately 50 times as much per pound as wheat.

In our rapidly changing economy which is becoming increasingly exacting in its demands for the application of business acumen it appears rather imperative that the principles which are basic to

practical improvement become activated into our flock operations. Research accomplishments will not be fully effective unless we do this.

In the effort to improve usefulness of the Rambouillet at this laboratory more attention is paid to meat than to wool production. The comparative economy of these two products justifies that attention and, fortunately it appears that under average range conditions, such as prevail here, there is a strong potential possibility in the Rambouillet for further improvement. The average clean wool production for ewes of all ages is 5 pounds in the laboratory flock. Mature ewes exceed that significantly. The lambs are, in general, free from skin folds, and command higher prices as feeder or fat lambs than wrinkled lambs. There is also room for improvement in selecting for increased fullness of body form, and this is not being overlooked.

PROGRESS IN INBRED LINES OF RAMBOUILLETS

The 1948 crop of offspring are added in the following table of inbreeding coefficients.

Average Inbreeding Coefficients in Percent							
Year lambed	No. of Potential inbred lines	Sires	Dams	Progeny	Increase of progeny over dams	Highest for progeny of any pen	Highest for any individual offspring
1938	20	4.0	1.1	3.9	2.8	13.3	37.9
1939	22	7.5	3.2	7.2	4.0	30.3	58.3
1940	34	6.0	3.6	8.2	4.6	32.6	58.3
1941	36	3.3	2.7	8.6	5.9	31.2	47.3
1942	37	4.1	4.0	8.6	4.6	28.7	39.9
1943	30	4.4	4.2	8.9	4.7	23.0	36.9
1944	30	5.0	5.0	10.3	5.3	22.8	48.0
1945	30	6.0	5.8	14.2	8.4	26.8	42.5
1946	30	5.9	7.1	14.1	7.0	25.7	39.4
1947	30	8.6	8.1	15.6	7.5	29.0	55.2
1948	29	14.6	9.7	17.1	7.4	30.5	42.9

The average inbreeding of all possible progeny increased to 17.1 percent in 1948. Only 2 of the sires of the 1948 lambs were not inbred as compared with 6 for 1947 lambs. The decreasing age of the sires also accounted for some of the increase in inbreeding of the sires of the 1948 lambs.

The average inbreeding coefficient of ram lambs weaned in 1948 was 15.6 percent and of those saved was 15.1 percent. The respective averages for ewe lambs was 15.9 and 15.9 percent.

The most highly inbred lines based on inbreeding of both parents and offspring were 34, 19, 24, 37, 20 and 32. All of these lines are of U. S. Sheep Experiment Station breeding. Considerable relationship existed within these lines when they were initiated in 1937.

The first 6 lines of each of the more important traits are listed in the following table for comparison with similar tables presented in previous years. These lines were ranked on adjusted averages from weanling offspring in 1948. Twenty lines were included in the table of which 15 were included last year.

Trait	1st	2nd	3rd	4th	5th	6th
Body weight	28	25	26	40	36	32
Body type	25	20	34	28	46	27
Condition	20	25	21	40	34	28
Staple Length	39	34	47	29	20	35
Open Face	40	50	51	44	35	46
Freedom from Folds	37	50	25	32	24	26
Index	40	50	28	35	25	51

Six lines (21, 32, 34, 40, 44, and 47) have ranked in the high six for one or more traits for each of the last 8 years.

Outcrosses were made in 2 lines in 1948-49. Two polled, registered Rambouillet rams were borrowed from the Montana Agricultural Experiment Station in 1947 and both gave satisfactory results in progeny tests. Both of these rams had fairly open faces. They were used in lines 24 and 32 to introduce the polled gene into these 2 lines.

PROPOSED CROSSING OF RAMBOUILLET LINES

The desirability of testing inbred lines for crossing ability relatively early in the development of the lines was agreed upon at the 1948 Collaborator's meeting. Crossing experiments are limited by the number of ewes available. Most of the lines have too few ewes available to permit adequate crossing with retention of the line. This limitation is being met by increasing the number of ewes in each line by culling fewer ewes. It seems likely that only a few ewes can be added to each line each year in this way. Increasing numbers by topcrossing does not seem feasible at present because of the expense.

Another complication to line crossing is the presence of both unregistered and registered Rambouillet lines in the flock. Many breeders will use improved Rambouillet sheep only if they are registered. Therefore, it may be important not to lose registered stock by mating registered ewes to unregistered rams which would occur in a line crossing program.

One idea of the comparative crossing ability of the various lines could be obtained by dividing all of the ewes at random to the various sires so that each line sire would be mated to 1 or more ewes from each of the other lines. This would materially reduce the number of ewes per line if repeated more often than once in about 5 years. Another plan would involve mating the excess ewes (above 25 to 30)from

each line at random to rams from part or all of the lines. This would not reduce the number of ewes per line below the arbitrary level but would give less information on crossing ability of the lines. This plan would give little information on specific combining ability of the lines. With any plan it would be desirable to use more than one sire from each line so that information on the variability of sires within a line could be obtained.

A third alternative would be to take 6 of the largest lines and use 2 rams from each line each year. Each ram would be mated to 10 ewes from his own line and 2 from each of the other lines. This should be repeated for at least 3 years and probably 5 years in order to give reliable information on all possible line combinations. This would provide estimates of the relative importance of general and specific combining ability. It would also provide inbred and outcross offspring from each sire. Reciprocal matings would allow for some evaluation of maternal effects.

The final line-crossing scheme which includes some of the best features of the previous plans, will probably be incorporated into the breeding plans. This scheme is illustrated in the following table:

		Ewes from line										
Line	Sire	21	23	43	25	44	22	40	45	49	50	51
21	A	10					2	2	2	2	2	2
	B	10					2	2	2	2	2	2
23	A		10				2	2	2	2	2	2
	B		10				2	2	2	2	2	2
43	A			10			2	2	2	2	2	2
	B			10			2	2	2	2	2	2
25	A				10		2	2	2	2	2	2
	B				10		2	2	2	2	2	2
44	A					10	2	2	2	2	2	2
	B					10	2	2	2	2	2	2
22	A						10					
	B						10					
40	A							10				
	B							10				
45	A								10			
	B								10			
49	A									10		
	B									10		
50	A										10	
	B										10	
51	A											10
	B											10

The same number of ewes from the six lines in the previous plan would be used for crossing with rams from five other lines. The numbers of ewes in lines 21, 23, and 43 are too small to permit reciprocal crossing, but the low merit of these lines makes it desirable to test them early to permit more accurate line culling. Line 25 is at present one of the best lines and line 44 is perhaps the most diverse in origin from the other lines. Lines 25 and 44 are included to prevent comparisons of the crossing performance of poor lines only.

With this plan, information would be obtained on the crossing performance of eleven rather than six lines using the same number of test ewes. The design is more efficient for comparing the five sire lines than for comparing the six ewe lines, if the latter are genetically different in their maternal influences on the lambs. This weakness could be partially corrected if excess ewes from lines 25 and 44 were available for reciprocal crossing.

The six ewe lines now have 40 or more ewes so that this plan could be carried on for 3 to 5 years without reducing the number of ewes per line below the average for all of the lines. At the end of 3 to 5 years culling of the lines with poorest combining ability would be feasable. The crossline ewe offspring produced could be retained and used for testing the general combining ability of rams from other lines with small numbers of ewes.

The advantages of this plan with the available animals are that it tests the lines on which crossing information is most needed, it provides information on more lines (although less information on each line tested), and it provides information on both general and specific combining ability of the lines.

LAMB PRODUCTION OF RAMBOUILLET FLOCK

A summary of lamb production for the past 25 years is presented in the following table. The percent of lambs born and weaned was higher than for 1947 but not as high as in 1946. Weaning weights were definitely below normal. The lambs are dropped in April and May and weaning records are taken about the middle of August, giving an average age near 130 days. The lambs receive no grain.

Year	No. of ewes bred	Percent of ewes pregnant	Percent of lambs born of ewes lambing	Percent of lambs weaned of ewes bred	Average weaning weight	Pounds of lamb per ewe bred
1924-29	1790	--	--	69.8	72.3	50.5
1930-39	2294	82.3	--	72.9	68.1	49.6
1940	805	87.9	122.0	86.5	79.1	68.4
1941	850	94.3	128.2	92.9	76.2	70.8
1942	1023	90.7	125.3	93.4	75.1	70.1
1943	903	88.0	124.9	91.6	83.4	76.4
1944	908	92.0	129.4	94.3	75.2	70.9
1945	962	91.7	123.4	92.2	69.8	64.3
1940-45	5451	90.8	125.6	91.9	76.3	70.1
1946	890	94.3	134.5	100.7	70.8	71.4
1947	897	90.0	124.1	88.3	70.6	62.4
1948	882	93.6	130.7	98.8	66.3	65.4

SELECTION PRACTICED ON RAMBOUILLET LAMBS

A higher proportion of lambs was saved in 1948 than in 1947. In 1948, 31% of ram lambs and 75% of ewe lambs were saved as compared with 26 and 65% respectively in 1947. Selective differentials were generally lower in 1948 than last year. Exceptions were staple length, type and condition for rams and type for ewes. Lower selection differentials could be expected in 1948 because a higher proportion were saved.

		Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
Rams	Advantage of selected lambs	.32	.20	5.95	.26	.13	.08
	Relative emphasis	.52	.43	.70	.54	.30	.32
	Expected Genetic gain	.179	.080	1.785	.034	.005	.031
Ewes	Advantage of selected lambs	.06	.04	2.00	.11	.06	.01
	Relative emphasis	.10	.09	.24	.23	.14	.04
	Expected genetic gain	.034	.016	.600	.014	.006	.004

The estimated annual genetic improvement from weanling selections would be the sum of the genetic improvement in the ram lambs and the ewe lambs divided by the total age of the parents when the offspring are born. These rates for each weanling trait from 1943 to 1948 are presented in the following table:

Year	Face covering score	Staple length (cms.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
1943	.013	.019	.184	.007	.001	.030
1944	.020	.011	.233	.009	.002	.030
1945	.025	.015	.319	.011	.002	.020
1946	.043	.016	.342	.006	.002	.018
1947	.041	.015	.385	.007	.001	.019
1948	.036	.016	.404	.008	.002	.006

These rates have increased for weaning weight, have remained fairly constant for staple length, type and condition and have decreased for neck folds. The rates for face covering increased until 1946 and have decreased since that time although they are still higher than in 1945 and before.

The average age of sires and dams decreased for 1948. The average age of sires and dams when their offspring are born for 1941 through 1948 are shown in the following table:

Year lambs were born	Average age of dams (years)	Average age of sires (years)	Average age of sires plus dams (years)
1941	4.41	4.00	8.41
1942	4.37	4.13	8.50
1943	4.23	3.63	7.86
1944	4.05	3.38	7.43
1945	4.01	3.40	7.41
1946	3.97	2.70	6.67
1947	4.07	2.43	6.50
1948	3.94	1.97	5.91

The generation length for rams and ewes is about 30 percent less in 1948 than in 1941 and about 9 percent less than in 1947.

SOME CHECKS ON THE USE OF THE WEANLING INDEX

Checks were made on Rambouillet lambs born from inbred lines in 1947 and 1948 on the importance of deviations from the index in selection. The results for lambs born in 1948 are shown in the following table:

SELECTION DIFFERENTIALS FOR RAMBOUILLET LAMBS FROM INBRED LINES IN 1948

	Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score	Index
			RAM LAMBS				
Actual selection (122 saved of 398 weaned)	.32	.20	5.95	.26	.13	.08	12.25
Selection exactly on index (26 lambs switched)	.39	.20	7.53	.27	.10	.06	14.65
Selection on index with the exception of 8 lambs with defects not covered by the index	.36	.20	7.49	.28	.12	.05	13.80
			EWE LAMBS				
Actual selection (355 saved of 473 weaned)	.06	.04	2.00	.11	.06	.01	2.92
Selection exactly on index (46 lambs switched)	.13	.06	2.69	.12	.05	.03	4.78
Selection on index with the exception of 19 lambs with defects not covered by the index	.09	.04	2.37	.11	.06	.02	3.84

The third line for each sex in the above table shows the selection differentials that would have been obtained if the index would have been followed exactly except where defects not covered by the index, such as overshot jaws, and too much color were present. This shows that failure to follow the index, except for defects, reduced selection differentials for face covering, weaning weight and type score in both sexes and neck folds in ewe lambs, and increased

selection differentials for condition score in both sexes and neck folds in ram lambs. Similar changes were found for 1947 lambs. The changes were more important on a percentage basis for the ewe lambs and on an absolute basis for the ram lambs. It appears that rather important gains in selection differentials for face covering and weanling weight could be made by following the index more closely. This is particularly true for ewe lambs where later selections will be less important.

In general, lambs saved in spite of a poorer index were less inbred than those for which they were switched but consistent differences were not found for environmental factors such as age, type of birth and age of dam.

The effectiveness of the index in accounting for measureable environmental effects was studied for all lambs from inbred lines of Rambouillets from 1945 through 1948. The results are shown in the following table:

EFFECTIVENESS OF INDEX IN ACCOUNTING FOR MEASUREABLE ENVIRONMENTAL EFFECTS

Years	Method	Average inbreeding		Average age		Twins raised as twins as percent of all lambs		Twins raised as singles as percent of all lambs		Percent from 2-year-old dams	
		Saves %	All %	Saves (days)	All (days)	Saves	All	Saves	All	Saves	All
RAMS											
1943,4	Without index	8.5	8.9	133.1	133.4	26.5	33.4	7.6	9.4	18.5	19.2
1945-48	With index	13.7	13.7	129.6	129.9	22.0	31.3	13.1	11.8	16.1	18.1
EWES											
1943,4	Without index	9.1	8.7	133.7	133.8	30.4	30.8	11.2	11.2	16.8	16.7
1945-48	With index	14.2	14.1	129.8	129.6	28.9	30.7	12.8	12.5	19.6	19.8

Environmental factors appear to have been adequately accounted for except for twins raised as twins. There appears to be a tendency to save a lower proportion of twins than occurred in the entire flock both with and without the index. This is not caused by failure to follow the index in selection.

THE RELATION OF FACE COVERING TO WOOL PRODUCTION IN RANGE RAMBOUILLET EWES

Data on lifetime wool production were studied from 798 Rambouillet ewes born during the years from 1938 to 1940. In addition, data on yearling wool production were obtained on 1701 Rambouillet ewes born during the years from 1941 to 1946.

On the average at yearling age covered-faced ewes excelled those with open faces by 0.09 pounds of grease wool and 0.05 pounds of clean wool. Neither of these differences were significant. Covered faced ewes had greater staple length by 0.16 centimeters than open-faced ewes. This difference was highly significant statistically. The within year correlation coefficients for each of the 3 fleece traits with face covering were low and nonsignificant, indicating that no important relationships existed. In general covered-faced ewes (born 1938-40) produced slightly heavier grease fleece weights (about 0.2 pound) throughout their lifetimes than open-faced ewes.

The slight relationship between covered faces and increased wool production is not large enough to be important. It is reasonable that wool blindness may appear earlier and be more apparent in those having long staple. There is also a tendency for weanling selections to retain the open-faced ewe in spite of a light fleece but to cull the covered-faced ewe with a light fleece. The advantage in grease fleece weight of the covered-faced mature ewes maybe explained by the greater lamb production of the open-faced ewes, as earlier work has shown that grease fleece weight is reduced by increased lamb production. In fact practically all of the disadvantage of the open-faced mature ewes in wool production can be explained by the effect of their greater lamb production.

SELECTING EWES FOR HIGH LAMB PRODUCTION

Data on lifetime lamb production were studied on 1246 Rambouillet ewes born during the years from 1938 through 1942 at Dubois, Idaho. A total of 4,299 ewe years were included.

Ewes having twins excelled in lamb production at each year of age weaning 9, 33, 40, 45 and 41 more pounds of lamb per ewe year from 2 to 6 years respectively than ewes having single lambs. Ewes having twins had more lambs born alive while those having singles weaned a higher proportion of their lambs. The single lambs weighed more at weaning.

Lamb production increased with age. The percent of ewes having lambs, percent of twins born, percent of live lambs born, percent of lambs and pounds of lamb weaned per ewe bred all increased with age up to 6 years which was the oldest group studied. Some of these changes were due to a changing proportion of the number of ewes having twins. The percent of ewes having twins increased from 3 at 2 years of age to 15, 32, 38 and 43 for 3 to 6 years of age respectively.

It should be possible in selecting for high lamb production to take advantage of the changing proportion of twin producing ewes with age. Lambs born as twins generally have a higher twinning potential than those born as singles. However, the twinning potential of lambs born as twins should decrease with the advancing age of their dams because as a larger proportion of the mothers have twins the twinning potential of their offspring would decline toward the average. Likewise the twinning potential of single lambs should also decline with the age of the mother as those 2-year-old ewes having singles almost represent the average of the entire flock but as 4-year-olds they should be near the average of the lower half of the flock in twinning potential. These trends are complicated by the culling of the poor lamb producers each year which should cause a slight increase in twinning potential with age of dam. They are further complicated by the environmental handicap of ewes from 2-year-old dams which should be superior genetically in twinning potential to offspring of 3-year-old dams but which actually produced fewer twins.

Ewes born as twins produced 6.8 percent more twins than those born as singles. This difference was markedly increased by considering age of dam in addition to type of birth. Twin ewes which were offspring of dams, 3, 4, 7 and up, 6 and 5 years of age produced 33, 28.5, 28.0, 26.9 and 25.8 percent twins respectively. Single ewes which were offspring of dams 7 and up, 3, 5 and 6, and 4 years of age produced 23.7, 23.4, 19.4 and 18.3 percent twins respectively. These values provide a basis for rating lambs at birth, weaning or yearling age on their potential twin production which will be more effective than using one value for all twins and one for all singles. Ram lambs can be selected on this basis to obtain hereditary gains even though these will not be revealed until their daughters produce lambs. These values will be particularly effective in selection because they can be applied to both sexes at an early age before any culling has taken place.

It is often desirable to cull on the first year's lamb production and this is effective in increasing the productivity of the flock immediately. There was a definite relation of lamb production in the first year to that in later years. Those ewes that did not have a lamb the first year had the lowest lamb production in later years averaging about 8 pounds of lamb per ewe year below average. Those that did not wean a lamb but had one dead lamb or one live lamb born averaged about 7 pounds and 3 pounds below average respectively. Those that had one lamb born dead and weaned a foster lamb were just about average in later lamb production. Those ewes having and weaning one lamb were about 2 pounds above average, about two-thirds of the flock were in this group. Those ewes having 2 lambs the first year had by far the best production in later years, producing 16 pounds of lamb per ewe year above average.

The above differences were influenced by culling after the first year of production. In general this tended to make the differences smaller as naturally more low producing ewes were culled from the groups

not weaning lambs the first year than from those that did. Deviations from average in pounds of lamb weaned per ewe bred in the third year, for ewes staying in the flock only 3 years, was -24, -21, -4, -7, +11 and + 45 for the respective groups in the preceeding paragraph. Thus ewes that had one lamb and raised it in their first lambing year weaned an average of 35 more pounds of lamb the next year than ewes dry their first year.

There was a definite relationship between weight of lamb weaned the first year and pounds of lamb weaned in later years. For each pound increase in weaning weight for the lamb weaned from the 2-year-old ewe there was an averaged increase of 0.7 pound per ewe year in later production.

This information makes available, for the first time, a fairly comprehensive basis for selecting sheep for genetic improvement in lamb production. This is particularly pertinent now as lamb production is increasing in importance because of high meat prices and declining sheep numbers.

SELECTION FOR OPEN FACE IN RAMBOUILLETS

The proportion of Rambouillet weanling lambs with various degrees of face covering from 1938 to 1948 are shown in the following table:

	Percent of lambs weaned with		
Years	Open faces	Partially covered faces	Covered faces
1938-41	12	45	43
1942-45	11	40	49
1946	25	48	27
1947	13	43	44
1948	12	45	43

The increase in the proportion of ewes with covered faces in 1942-45 as compared with 1938-41 appears to have been due to a slight change in scoring standards. If scoring standards had remained constant since 1942-45 it is probable that the records would have revealed more progress toward the open face. It is the tendency to become more critical of the wool blind condition year by year whereupon the records may not show actual gains. This may be true in spite of the fact that the proportion of lambs in the various classes are identical in 1948 to that for 1938-41.

SELECTION AGAINST FOLDS IN RAMBOUILLETS

Proportions of weanling Rambouillet lambs with various degrees of neck folds since 1938 are shown in the following table:

Years	Percent of lambs with		
	No folds	Trace of folds	Moderate to heavy folds
1938-1941	8	35	57
1942-1945	34	38	28
1946	69	21	10
1947	56	29	15
1948	83	14	3

These results show remarkable progress in eliminating folds in Rambouillets. In 1938 to 1941 over half of the Rambouillet weanling lambs had moderate to heavy folds while in 1948 only 3 percent of the lambs fell in this class.

CORRELATIONS AMONG RAMBOUILLET RAM RECORDS

Preliminary results have been obtained on correlations among ram traits at various ages from weaning to 5 years of age. This study is not yet complete but some of the relationships observed have already been used in calculating a selection index for rams.

Estimates of repeatability of yearling ram records have been obtained from the correlations of 1 and 2 year records for all rams remaining in the flock 2 years. The correlation coefficients are 0.82 for face covering, 0.75 for staple length, 0.71 for grease fleece weight and body weight, 0.62 for clean fleece weight, 0.58 for neck folds, 0.40 for type score and 0.37 for condition score. All of these are statistically significant. It is reasonable that clean fleece weight should be more repeatable than grease fleece weight. The lower value for clean fleece weight may mean that some error is introduced in obtaining the clean yields from small samples. Values for type and condition scores are lower than for the other traits but are slightly higher than earlier estimates.

Highest relationships between traits were found for clean fleece weight with grease fleece weight, and condition score with type score. Grease and clean fleece weight had significant correlations with staple length, weight, type, condition and neck folds. All were positive in the sense that improvement in one was associated

with improvement in the other except the relationship with neck folds which was low but significant. Staple length showed a significant, but low correlation with neck folds, smoothness being associated with longer staple. Type and condition were related to body weight. Face covering showed no significant correlations with other traits.

PREDICTING LIVE NORMAL SPERM IN RAMS FROM MOTILITY SCORES

A study was made to determine the reliability of using visual estimates of motility to predict the percent of live normal sperm as counted on opal blue and eosin stained smears. 1140 ejaculates were analyzed from 428 ram trials of 30 minutes using Rambouillet, Columbia, Targhee and Corriedale rams over a period of 3 years. Percentages were transformed to angles and the regression of motility on live normal sperm calculated. An empirical transformation and combination of motility percentage and score gave a nearly perfect fit. This latter transformation was then reapplied to the original data and a second analysis was made.

The total correlation between motility estimate and percent of live normal sperm was +.83 which with all measurable effects removed was reduced to +.34 for ejaculates within ram trials. Means for years showed an improvement with time which was to be expected from improvements being made in management of the rams. Breed differences were significant while the number of ejaculates per trial and the positional order of the ejaculate had no effect on means. In general visual estimates were more variable than counts from slides. The repeatability of visual estimates and counts were nearly identical at 0.8 which is highly significant. Repeatability of predicting count from visual estimate was .40 for ejaculates, .45 for trials and .24 for years.

The results show that visual estimates of motility may be transformed into an estimate of percent live normal sperm. The estimate is repeatable and has good predictive value for percent of live normal sperm. Visual estimates of sperm motility are therefore a useful measure of semen quality which can be obtained quickly and easily. These results indicate that more than one ejaculate is necessary to give an adequate trial for a ram but that one adequate trial in any one year will probably give an accurate value for that ram.

BELLY WOOL SCORE AND MEAN AND VARIABILITY OF FIBER DIAMETER OF FLEECE

The relations of mean fiber diameter, variability of fiber diameter and amount of belly wool to weanling staple length and body weight, and yearling grease fleece weight, adjusted clean weight, face covering, staple length, body weight, type, condition and neck folds were calculated for 387 Rambouillet, 148 Targhee and 170 Columbia yearling ewes born in 1942 and 1943.

For mean diameter, only the correlations with grease fleece weight and adjusted clean weight were consistently significant within each of the breeds and for the three breeds combined. No indication was found that mean diameter per se would add any value to a selection index. Rams with heavier grease or clean fleece weights than their mean diameter would predict might be given extra consideration in selection. In the data for mean diameter, environmental effects of type of birth and year of birth contributed more than 2 percent of the total variance for Columbias and age at shearing contributed more than 2 percent for Targhees. Other environmental effects were not significant. Heritabilities from half-sib correlations were moderately high in Columbias and Targhees and somewhat higher for Rambouillets.

Variability of fiber diameter failed to show consistently significant correlations with any trait except type. No reasonable explanation can be given to account for this relationship. It is possible that fleeces of more uniform diameter present a more pleasing appearance which influences the scoring of type. Environmental factors had little effect on variability, the only two effects which contributed more than two percent to total variability sum of squares being years and regression on age at shearing. Heritabilities were low and nonsignificant.

Belly wool showed significant relationships to grease fleece weight and clean fleece weight for all three breeds and a combination of the three. Relationships to staple length were consistently just below the 0.5 probability level but gave a highly significant relationship for the breeds combined. It would appear that belly wool is related to these other wool characters in a physiological and physical manner. Length of staple is probably the basic factor in causing increased belly wool, but the relationships indicate that the area of wool on the belly is also a factor.

Environmental effects had little influence on belly wool, only type of birth consistently contributing more than 2 percent of total variation for each of the 3 breeds. Inbreeding was important only for Targhees.

Heritability of belly wool varied from 0.6 for Columbias in 1943 to .82 for Targhees in 1943 when environmental factors were disregarded. After adjustment for environmental factors and combining years the heritability for Columbias was still not significant at .21, but highly significant for Targhees and Rambouillets at .61 and .51. This apparent discrepancy in Columbias may be related to differences in area of belly covered with wool. These heritabilities are considerably higher than for weanling traits, but comparable to other yearling traits. Preliminary estimates from daughter-dam regressions would indicate that these results are not too high.

In summary, belly wool shows promise of contributing to the ability to select superior wool-producing animals. No indications of general applicability are evident for mean diameter of fiber or its variability.

COMMERCIAL GRADES OF RAMBOUILLET FLEECES

In 1948 there was an increase in the proportion of rams and yearling ewes grading Fine Staple. All of the mature ram fleeces

		Yearling			Mature		
		Fine French (%)	Fine staple (%)	1/2 Blood (%)	Fine French (%)	Fine Staple (%)	1/2 Blood (%)
Rams	1942-45	6	92	2	6	92	2
	1946	7	93		4	96	
	1947	9	91		2	98	
	1948		97	3		100	
Ewes	1942-45	21	75	4	47	50	3
	1946	3	91	6	19	75	6
	1947	9	88	3	33	65	2
	1948	2	91	7	40	54	6

graded Fine Staple but there was a slight increase in the proportion of fleeces grading 1/2 Blood among yearling rams and ewes. Mature ewes had a lower proportion of ewes grading fine staple with increases in the Fine French and 1/2 Blood grades. It is probable that changes in grading standards account for a significant portion of the variations occurring from year to year.

SCOURING AND SORTING OF FLEECES

The majority of the 1948 clip was sent to the Texas Agricultural Experiment Station for sorting and scouring. The results of the sorting are not complete due to the use of various portions of the clip for experimental purposes. In addition, the Denver Wool Laboratory core-bored the various graded lots to give additional yield estimates. The scoured lots of wool were consigned to and sold by Beatty and Hyde. The wool market was not favorable at the time of sale.

DATA FROM SORTING REPORT 1948

Graded Lots of Wool	Pounds of Grease Wool in Sorts									
	Clear	Burry	Stain	Paint	Low	Tags	String	Cores	Bags	Total
Fine staple mature ewe	5951	503	92	253	58	7	21	219	100	7204
1/2 Blood mature ewe	4383	294	48	173	38	6	12	202	78	5234
3/8 Blood mature ewe	3297	132	56	77	62	9	9	138	54	3834
3/8 Blood yearling ewe	195	22	2	0	2	0	1	10	4	236
Fine Staple Ram	1492	137	50	24	21	3	3	49	24	1803
1/2 Blood Ram	245	23	8	6	1	1	1	10	4	299
3/8 Blood Ram	714	75	23	16	34	4	3	28	12	909

Note: Complete reports on sorting are not available for some grades.

DATA FROM SCOURING REPORTS, 1948

Lot No.		Grease weight	Clean weight	Yield in percent	Yield for Grade	Core* yield in percent
1	Fine Staple	2920	1477	50.6		
2	Fine Staple	2835	1440	50.8		
3	Fine Staple	781	371	47.6	49.6	51.4
4	Fine Staple	2859	1450	50.7		
5	Fine Staple	1751	800	45.7		
6	Fine French Combing	2037	1002	49.2		
7	Fine French Combing	1765	870	49.3	49.2	49.6
8	Fine French Combing	161	87	54.5		
9	Fine French Combing	133	59	44.8		
10	1/2 Blood Staple	1897	975	51.4		
11	1/2 Blood Staple	1907	992	52.0		
12	1/2 Blood Staple	1655	856	51.7	51.0	51.3
13	1/2 Blood Staple	542	260	48.0		
14	1/2 Blood Staple	902	441	48.9		
15	3/8 Blood Staple	2254	1255	55.7		
16	3/8 Blood Staple	2255	1213	53.7	53.9	51.2
17	3/8 Blood Staple	545	288	52.9		
18	3/8 Blood Staple	927	469	50.6		
19	1/4 Blood Staple	394	213	54.3		
20	1/4 Blood Staple	1805	1038	57.5	57.7	53.6
21	1/4 Blood Staple	1973	1166	59.1		
22	1/4 Blood Staple	574	325	56.7		
23	Rambouillet Crutchings	621	236	38.0		36.6
24	X-Bred Crutchings	1054	413	39.2		39.2
25	Grading Locks	488	182	37.4		41.2
26	Black	344	162	47.2		
27	Stained, Fine and 1/2 Blood	82	31	38.1		
28	Stained, 3/8 and 1/4 Blood	28	10	37.9		
29	Burry, Fine and 1/2 Blood	293	136	46.5		
30	Burry, 3/8 and 1/4 Blood	135	63	47.1		

* Yields determined by Denver Wool Laboratory.

SALE OF SCOURED SORTS 1948

Lot No.	Description of Wool	Net clean weight	Appraisal value per pound	Total Value
1	Fine Staple	4,091	$1.4355	$ 5,872.63
2	Fine French	1,696	1.3860	2,350.66
3	1/2 Blood	2,661	1.3365	3,556.43
4	3/8 Blood	2,408	1.2573	3,027.58
5	1/4 Blood	1,781	1.1484	2,045.30
	OFFSORTS			
6	Burry, Fine and 1/2 Blood	513	1.2870	660.23
7	Stain, Fine and 1/2 Blood	131	1.1385	149.14
8	Paint, Fine and 1/2 Blood	316	1.1583	366.02
9	Low, Fine and 1/2 Blood	100	1.2375	123.75
10	Burry, 3/8 and 1/4 Blood	260	1.0098	262.55
11	Stain, 3/8 and 1/4 Blood	121	1.0197	123.38
12	Paint, 3/8 and 1/4 Blood	110	1.0098	111.08
13	Low, 3/8 and 1/4 Blood	88	1.1286	99.32
14	Low, 1/4 Blood	163	1.0494	171.05
15	Crutchings, Rambouillet	238	1.1583	275.68
16	Crutchings, Crossbred	430	0.9999	429.96
17	Grading, Locks	191	1.0098	192.87
18	Black	160	0.8712	139.39
	TOTAL			$19,957.02
	Deductions*:	Handling charges		646.84
		Scouring or carbonizing		2,883.85
		Freight		633.16
		Trucking		18.20
		Service and Appraisal (CCC)		606.41
		TOTAL		$4,788.46

* These charges include the Beltsville clip (626 lbs.).

SUMMARY OF 1948 FLEECE WEIGHTS BY GRADES

Breed	"SF" No.	"SF" Total	"F" No.	"F" Total	"SS" No.	"SS" Total	"S" No.	"S" Total	"1/2" No.	"1/2" Total	TOTAL No.	TOTAL Total
						MATURE EWES						
RW	21	190.6	73	649.6	3	29.2	131	1242.3	13	126.8	241	2238.5
W	57	492.8	236	2064.2	16	151.0	357	3329.0	40	385.0	706	6422.0
S	19	175.3	71	651.4	8	72.0	120	1181.7	18	186.0	236	2266.4
TOTAL	97	858.7	380	3365.2	27	252.2	606	5753.0	71	697.8	1183	10926.9
Ave.		8.85		8.86		9.34		9.46		9.82		9.24
						YEARLING EWES						
RW							76	746.8	6	64.5	82	811.3
W			6	47.9			160	1751.0	10	109.6	196	1908.5
S							38	393.4	6	64.9	44	458.3
TOTAL			6	47.9			294	2891.2	22	239.0	322	3158.1
Ave.				7.98				9.83		10.86		9.81
						MATURE RAMS						
RW							24	351.2			24	351.2
W							66	955.6			66	955.6
TOTAL							90	1306.8			90	1306.8
Ave.								14.52				14.52
Merino							2	33.6	1	19.9	3	53.5
Ave.								16.8		19.9		17.83
						YEARLING RAMS						
RW							21	242.0	2	23.3	23	265.3
W							64	703.4	1	11.4	65	714.8
S							13	164.0			13	164.0
TOTAL							98	1109.4	3	34.7	101	1144.1
Ave.								11.32		11.57		11.33
DLF							2	25.3			2	25.3
Ave.								12.65				12.65